

REMARKS

Claims 4, 6 through 9, 15, 16, 24, 26, 27, 29 and 30 are now pending in this application. In response to the Office Action, dated November 29, 2002, claims 1 through 3, 5, 10 through 14, 17 through 23, 25 and 28 have been cancelled, claims 6, 7, 15, 24 and 26 have been amended and new claims 29 and 30 have been added. Filed herewith in a separate letter for approval are proposed corrections to the drawings with changes shown in red on photocopies. Care has been taken to avoid the introduction of new matter. Favorable reconsideration of this application as now amended is respectfully solicited.

Section 1 of the Office Action itemizes several objections to the drawings for lacking illustration of claim features. For each itemized objection, either the drawing has been corrected to show the claim feature, the claim requirement has been deleted, or explanation is presented as to why the feature has already been illustrated. No new matter has been presented as each drawing correction corresponds to a feature described in at least a claim of the original disclosure.

The magnetic polarities discussed in the objections of items (1) and (2) have been added to Fig. 6. The features discussed in the objections of items (3), (5) and (6) have been deleted from the claims. The objections discussed in items (4) and (7) pertain to the claimed segmented back iron portions of the rotor. As evident from Fig. 6, back iron segment 25 comprises two separated portions, 26 and 27, portion 26 bridging central magnet 22 and lateral magnet 23, portion 27 bridging central magnet 22 and lateral magnet 24, magnets 22-24 aligned axially in a row. Thus each of the claim features at issue is shown in Fig. 6.

Approval of the proposed drawing corrections and withdrawal of the objections are respectfully solicited.

Claims 1, 3, 5 through 9, 21, 22 and 24 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. patent 5,854,521 (Nolle) as set forth at section 3 of the Office Action. Of these claims, claims 1, 3, 5, 21 and 22 have been cancelled. Claims 6 through 9 are now dependent from new independent claim 29. Claim 24 has been amended. For the reasons stated below, it is submitted that each of these remaining claims distinguishes from Nolle.

Claim 29 is reproduced below as follows:

29. A rotary electric motor comprising:

a cylindrical annular permanent magnet rotor disposed coaxially about an axis of rotation;

a stator comprising a plurality of separate electromagnets having respective core segments; and

a non-ferromagnetic support structure, the stator core segments affixed thereto and distributed without ferromagnetic contact with each other in an annular ring concentric with the rotor and separated therefrom by a radial air gap, the core segments thereby respectively defining separate magnetic paths isolated from each other; wherein each stator core segment further comprises:

a center pole and two lateral poles having pole face surfaces at the air gap, the center pole integrally joined on each axial side thereof by a linking portion to a respective lateral pole to form an axial row of stator poles parallel to the axis of rotation, the linking portions being radially offset, relative to the stator poles, from the air gap; and

a winding, exclusive to its respective core segment, to develop concurrently, when energized with current, one magnetic polarity in each of the lateral poles and an opposite magnetic polarity in the center pole.

As can be seen above, claim 29 not only requires that the stator electromagnet core segments be separate, but that they be affixed to a non-ferromagnetic structure such that the core segments define separate magnetic paths isolated from each other. This feature is similar to the requirements of now cancelled claim 2. As recognized in the second paragraph of section 4 of the Office Action (page 6), Nolle does not disclose stator core segments affixed to a non-ferromagnetic support structure and thereby distributed in the stator ring without ferromagnetic contact with each other. That is, Nolle does not anticipate this claim feature.

Claim 29 also requires that each stator core segment have a winding exclusive to that segment to develop concurrently, when energized with current, one magnetic polarity in each of the lateral poles and an opposite magnetic polarity in the center pole. Nolle does not disclose this claim arrangement. The rotary motor of Nolle is shown in a simplified schematic in Fig. 2. The structural arrangement of stator and rotor elements and stator winding configuration are described in conformance with the corresponding elements of the linear transverse motor of Fig. 1. As disclosed, Nolle provides three windings (15, 16, 17, Fig. 1), which are configured to be energized in a three phase sequence (column 3, lines 30+). Each winding is formed in common with a plurality, or all, of the stator lamination elements. Winding 15 is formed on the left hand pole (11a, 12a, 13a, . . .) of the stator lamination elements (11-14 . . .), winding 16 is formed on the center pole of each of the stator lamination elements, and winding 17 is formed on the right hand pole of each of the stator lamination elements. None of the windings of Nolle is exclusive to one stator lamination element. Energization of one of the windings does not concurrently cause development of one magnetic polarity in each

of the outer poles of a stator lamination element and an opposite magnetic polarity in the center pole.

It is submitted, therefore, that claim 29 and its dependent claims 6 through 9 are not anticipated by Nolle under 35 U.S.C. § 102. It is further urged, as will be discussed below, that the subject matter of these claims would not have been obvious from the standpoint of 35 U.S.C. § 103 upon consideration of Nolle individually or in combination with the teachings of the other references of record.

Independent claim 24, as amended, requires *inter alia*,:

a plurality of axial rows of permanent magnets disposed circumferentially about an axis of rotation, each axial row comprising a center permanent magnet of one magnetic polarity and, at each axial side thereof, a lateral permanent magnet of a magnetic polarity opposite to the polarity of the center magnet, the magnets of each axial row being in alignment with each other in parallel with the axis of rotation and coextensive with each other circumferentially about the axis of rotation.

The rotor magnets of Nolle, as shown in Figs. 1 and 2, are not aligned with each other in axial rows that are parallel with an axis of rotation. Fig. 1 depicts a linear motor that does not have an axis of rotation. The rotary motor version of Nolle is illustrated in Fig. 2. Correlating the magnet configuration of the two embodiments finds three transverse rows of aligned magnets in Fig. 1 (21a . . . , 22a . . . , 23a . . . ) that correspond to three circumferential rows of magnets, each row perpendicular, not parallel, to the axis of rotation. In the axial direction, magnets 21a, 22a and 23a are all offset from each other. This offset is necessary in order to operate appropriately with three phase winding energization of the stator. It is submitted, therefore, that claim 24 is not anticipated by Nolle. Withdrawal of the rejection is respectfully solicited.

Claim 2 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Nolle in view of U.S. patent 3,914,859 (Pierson) as set forth in section 4 of the Office

Action. Claim 2 has been cancelled herein, although recitation similar to claim 2 has been incorporated into new claim 29. Pierson is described in the Office Action as disclosing stator core segments affixed to a non-ferromagnetic support structure, distributed without ferromagnetic contact with each other to prevent magnetic flux interference with each other.

This characterization of Pierson is not completely accurate, particularly in comparison with the requirements of claim 29. While the stator teeth of Pierson are fit into a nonmagnetic cylindrical support 10, the stator teeth are not distributed without ferromagnetic contact with each other to define separate magnetic paths isolated from each other. Referring to Fig. 1 (column 3, lines 16+), housing 32 functions as a magnetic flux return path. The housing is formed of a cylinder of magnetic material into which the stator assembly is inserted. Contrary to the claim requirement at issue, Pierson requires a common magnetic circuit among the stator teeth. The nonmagnetic support 10, to which the Office Action refers, does not provide the common magnetic circuit because such provision would prevent appreciable flux generated by stator energization from traversing the air gap to the rotor. Nonmagnetic support structure at the air gap avoids magnetically short circuiting adjacent stator teeth. The ends of the teeth remote from the air gap, however, have a shared magnetic flux return path by means of the magnetic support housing 32.

Thus, as neither Nolle nor Pierson provides a common magnetic path among the stator poles at the air gap, a person of ordinary skill in the art would have had no motivation to modify the Nolle device to provide the structural feature of Pierson. Even if such modification were to be made, however, there is still no prior art teaching to distribute separate stator core segments without ferromagnetic contact with each

other thereby to define separate magnetic paths isolated from each other as required by claim 29. Pierson, in fact, teaches away from such modification as a common magnetic path for adjacent stator elements, provided by housing 32, is described as being essential. It is submitted that claim 29 patentably distinguishes from the teachings of Nolle and Pierson, considered either separately or in combination.

Claims 4 and 23 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Nolle in view of U.S. patent 6,204,587 (Torok) as set forth at section 5 of the Office Action. Claim 23 has been cancelled. Claim 4 has been amended to depend from new claim 29. Claim 4 adds a requirement that the surface area of the center pole face of a stator core segment is different from the surface area of a lateral pole face of the respective core segment. Fig. 13B (column 13, lines 60-70 and col. 14, lines 40-45) of Torok has been relied upon for disclosing a center pole face of a stator segment having a surface area different from the surface area of a lateral pole face of the segment. Torok has not been relied upon for disclosing the features of base claim 29, discussed above.

Torok discloses a motor having both permanent magnet poles and reluctance poles on the stator. The Office Action asserts, as motivation for modifying the Nolle structure, that Nolle and Torok "are in the same field of endeavor." It is submitted that such statement cannot substitute for a stated rationale as to why a person of ordinary skill in the art would have been led to a modification of the Nolle structure and detailed explanation of what modification is being proposed. The Office Action has not established that changing the surface area of the center pole face of the Nolle stator elements would improve flux density in the Nolle apparatus, simply because Torok, which discloses a vastly different pole structure attains the stated advantage. The so-

called purpose of optimizing flux density in Nolle is merely unfounded speculation. It is submitted that a person of ordinary skill in the art more likely would have concluded that changing the surface area of the center pole relative to the other poles of the stator element would have degraded motor operation of the Nolle device as three phase motor operation would become unbalanced. In any event, it is submitted that the Office Action does not meet the burden, under 35 U.S.C. § 103, to convincingly explain why an artisan would have been compelled make a specific prior art modification.

Moreover, aside from the issues regarding the additional recitation of claim 4, it is submitted that the distinctions of parent claim 29 discussed above with respect to Nolle have not been overcome by the additional teachings of Torok. In fact Torok has not been relied upon in the Office Action for teaching such features. Withdrawal of the rejection is respectfully solicited.

The rejection of claims 10 through 12 at section 6 of the Office Action is now moot as claims 10 through 12 have been cancelled. The rejection of claims 13, 14 and 17 through 20, at section 7 of the Office Action is now moot as claims 13, 14 and 17 through 20 have been cancelled. In passing, it is noted that the rejections of these claims relied upon U.S. patent 5,030,867 (Yamada) for disclosing a motor wherein the surface of each permanent magnet of a row of rotor magnets is coextensive in the axial direction with the surface area of a corresponding magnet in other rows; U.S. patent 4,754,207 (Heidelberg) was also relied upon for disclosing a rotor back iron ring upon which magnets are mounted. For the record, it is submitted that consideration of these references together with the teachings of Nolle and Torok would not have led a person of ordinary skill in the art to the motors required by independent claims 29 and 24. For example, neither Heidelberg nor Yamada disclose magnetically isolated stator elements

having three poles in axial alignment with windings formed on linking portions between poles, the linking portions and the poles being at a different radial distances from the air gap.

Claims 15 and 16 have been rejected under 35 U.S.C. § 103(a) as being over Nolle in view of Yamada, Heidelberg and U.S. patent 4,012,651 (Burson), as stated in section 8 of the Office Action. Burson has been relied upon for teaching a segmented support ring upon which rotor permanent magnets are mounted. The statement of the rejection asserts, without further explanation, that "Nolle . . . , modified by Yamaha [sic] . . . and Heidelberg . . . shows all limitations of the claimed invention" except for segmented back iron ring support.

Claim 15 is dependent from claim 7, which is dependent from new independent claim 29. Claim 16 is dependent from claim 15. It is recognized that the statement of the rejection in the Office Action was directed to claims 15 and 16 as they had originally depended from now cancelled claim 1. Reconsideration of the rejection in light of the substitution of new claim 29 for claim 1 as the parent claim is respectfully solicited. As pointed out above, neither Heidelberg nor Yamada disclose magnetically isolated stator elements having three poles in axial alignment with windings formed on linking portions between poles, the linking portions and the poles being at a different radial distances from the air gap. Nolle, Torok and Burson also are deficient as teaching these claim requirements. It is submitted, therefore, that claims 15 and 16 are patentably distinguishable.

Claims 25 and 28 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Nolle in view of Yamada and Heidelberg at section 9 of the Office Action. Claims 26 and 27 have been rejected under 35 U.S.C. § 103(a) as being



unpatentable over Nolle in view of Yamada, Heidelberg and Burson at section 10 of the Office Action. In explanation of these rejections, the Office Action merely states that "all limitations of the claimed invention has [sic] been fulfilled" by the cited references.

As claims 25 and 28 have been cancelled, the rejection thereof is now moot. Claim 26 has been amended to more particularly define the rotor segmented back iron ring, similar in recitation to claims 15 and 16. Claims 26 and 27 are dependent from parent claim 24. As pointed out *supra*, claim 24 requires that the rotor magnets of each axial row are in alignment with each other in parallel with the axis of rotation and coextensive with each other circumferentially about the axis of rotation. As the Nolle structure requires offset of the rotor magnets in the axial direction, it neither anticipates the claim requirements of claims 26 and 27, nor is amenable to the modification presumably proposed in the Office Action as axial alignment of the rotor magnets would destroy the intended operation of Nolle. Withdrawal of the rejection of claims 26 and 27 is respectfully solicited.

Accordingly, it is submitted that the application as presently amended is now in condition for allowance. A Notice of Allowability is respectfully solicited.